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Mobile applications for natural parks: guidelines study for the development of a mobile device application

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Abstract

Context aware mobile applications are being adopted as a premium solution to enhance and augment the user experience of visitors of natural parks and other public and open spaces. Under this assumption, this paper reports on a selection of existent mobile park applications featuring a set of tests that helped electing their key features. The performed evaluation also allowed setting up a proposal for design guidelines aiming the development of such a kind of applications.

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1. Introduction

A natural park is a specific area of a country that has cultural, historical and natural relevant features. Over the years, the mindset of the population in relation to these places has changed, mainly due to the encourage of medicine, social well-being and health in the twentieth and twenty-first centuries [1]. Nowadays, the contact with nature is seen as a more effective treatment than any other physical, mental or spiritual procedure [1]. However, this steady growth has also made it necessary to change the way parks and nature reserves are seen by both visitors and managers, since these can have a major environmental impact if aware how to correctly interact with this kind of environment. In this case, mobile access to geo-located information can be seen as a possible strategy to increase visitors' awareness, making their presence safer for them and for the environment. Based on these ideas, the aim of

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this study is to create a mobile device application for natural parks context to assist the various stakeholders. For that, it is necessary to have a set of guidelines for interface design as a basis to help with the development of a complete and well-built product, matching the target needs and characteristics of such an application.

Given that mobile devices contain limitations such as a relatively small screen, low battery life, small keyboard, and are sometimes difficult to use, it is necessary to take all these factors into account, which will determine a good user experience by the target audience. Furthermore, it is important not only for the experience itself, but also in order to understand the main features that such application should have so that it can provide as much information as possible bearing in mind their degree of relevance and ease of access. These are all variables that can be evaluated using different methods. The first step consisted in gathering a set of applications in the same study context in order to realize what's already available in the market, as well as the main functionalities that are provided and used. In addition, it is important to understand the advantages and disadvantages of each. Finally, it is necessary to realize what are the main interface design guidelines be taken into account when developing an application in this domain. This is especially relevant, taking in consideration the constraints of the device and the need to develop an app that must provide a good user experience and satisfaction among the target audience when they use it. It is worth to refer that this is a MSc research (of the Master in Multimedia Communication of the University of Aveiro), which development work was done in an enterprise context, namely in the AzorIT Systems, a company focused on the new technologies, who desired to create a product that could be a market reference and customizable by their clients. The referred study was then performed with the main objective of understanding the best practices for developing a mobile application in the context of natural parks, through an adequate methodological process.

2. Existing applications

This section aims to analyze seven distinct applications focused on natural parks, which were found using a market study based on the available rating in Apple store and Google Play. This help us to get the most possible heterogeneity sample in terms of design, functionality and content, allowing a deeper view of what can and should be included in a mobile application for natural parks. The application description, its features, main strengths and weaknesses will also be exposed. These analyses were not entirely implemented over the interface, but to the application as a whole, helping with a project development. It should be noted that the conducted research was performed in a real scenario with the various applications running on a mobile device.

2.1. GA State Parks Outdoors Guide

This application [2] is part of a project created by PocketRanger Exchange [3], which has a wide range of applications targeted for various natural park guides. This project emphasis challenges through the use of GPS features, enhancing using experience in the exploration of the sites. Not only does it contain all the information about the parks, but also a social network component that allows users to share their experiences through sharing features or friend searching. One of the main advantages of this application is based on offline access to the park map if it is saved by the user on the device. Something very relevant for this project is the existence of security mechanisms for the user to visit the park, a condition which is required by most park managers according to a study for the application WebPark [12].

2.2. Chimani Yosemite National Park

Chimani [4], from Kerry Gallivan, is a project that aims to solve some of the parks visitors' problems. During a walk, Kerry felt the need to get extra information from where he was - which way to go and what weather conditions he should take into account, but had neither telephone coverage nor applications to help him. So, Chimani Yosemite National Park is a Yosemite National Park application place in this project where many more parks are included, such as the Grand Canyon or Yellowstone Park. All the information is presented using intuitive interfaces, through a well-constructed design, constantly maintaining maps and content updated. The content is stored locally when downloading the application, making it an asset in its use in remote places. It has a suitable design to the theme with

suited content to the preparation of any intended user activity, also giving great focus on security issues through the provision of information about various support services available to visitors.

2.3. National Parks by National Geographic

National Parks by National Geographic [5] is an application available to iPad and iPhone that includes the various U.S. national parks. Through this application, it is possible to get access to a huge variety of information relating with the parks, such as the activities, best observation sites and contacts. The strength of this application is based on its innovative design, as well as the quality of its photographs, which belong to the best photographers of National Geographic. It has a great design having regarding the theme, which provides an excellent user experience. Being all visual issues the key elements of any application, the pictures need to possess good quality and this is something that the implementation of National Parks by National Geographic can deliver.

2.4. Official Great Smoky Mountains

Official Great Smoky Moutains [6], as its name implies, is an application focused on the Great Smoky Moutains, providing methods for trip planning as well as monitoring during the visit to the mountains. This application, like many others, has the particularity of using all the information and maps in offline mode without the need of external connection. The main advantage is the application offline access to the entire contents. It also allows access to information organized by categories, one of many ways to list major amounts of information. Finally, when compared to other applications, it has a few features based on the needs of users and park managers.

2.5. Chesapeake Explorer

This application [7], provided by the National Park Service (NPS), unlike many others, is mainly focused on the search for several existing parks and trails in the area of the Chesapeake Bay. It is not intended to serve as a personal guide for each of the parks, but only to inform about various parks in the area, functioning almost as a catalog. In addition, it features a long list of possible excursions of various types, from driving to hiking. This application allows you to access information without costs of download and it works offline. It also has a sophisticated design.

2.6. Oh, Ranger! ParkFinder

Application created by American Park Network [8], it gaims to provide its users with a list of parks near their location, or even a specific location that is not the actual one. It has a wide range of parks and reserves of all U.S.A. states. In each of these parks there is available a list of activities that are possible to perform as well as the directions to get there. It is a small and simple application since it doesn't provide major amounts of information, and has been targeted and advertised by the media, including The New York Times or even the website Gizmodo.

2.7. Parque Natural do Pico

The application of the Parque Natural do Pico [9], developed by AzorIT Systems in partnership with Azorina (Environmental Management and Conservation Society of Nature SA - Horta), has as its main objective the dissemination of the natural landscape of the region, as well as the landscape of the Vineyard Culture of Pico. Through mobile devices, it provides a vast amount of relevant information to its visitors, for example, the interpretation centers location, trails or protected areas. Online access is also required to download content, but only for the first time.

3. Features

After the analysis regarding the market for mobile applications for natural parks, it was important to understand which main features existed in each, taking into account the relevance to the user experience (table 1).

Table 1. Features detected in the applications study

LOD	GA State Parks Outdoors Guide	Chimani Yosemite National Park	National Parks by National Geographic	Official Great Smoky Mountains	Chesapeake Explorer	Oh, Ranger! ParkFinder	Parque Natural do Pico
POI search ("Points of Interest")	✓	✓			✓	✓	✓
POI search by activity	✓	✓		✓	✓		
Access to park information	✓	✓	✓	✓	✓	✓	✓
Access the weather information	✓	✓	✓	✓			
Access to security alerts, such as storms, closed trails, etc.			✓				
Events within the park	✓	✓	✓			✓	
Park news	✓	✓	✓				✓
Access to the park map with all the points of interest	✓	✓	✓		✓		✓
Access to trails	✓	✓	✓		✓		✓
Information on accessibility for people with special needs	✓	✓	✓	✓			
Access to services available in the park		✓	✓	✓		✓	✓
Directions to a specific location		✓	✓	✓	✓		✓
Information of the commercial partners (restaurants, hotels, transportation)	✓	✓		✓			✓
Offline access to the content		✓	✓	✓	✓	✓	✓
Offline access to the map	✓	✓					✓
GPS tracking along the trails	✓				✓		✓
Multilanguage							
Fauna and Flora information		✓					

Also, according to a study developed on the WebPark project context [12], it was observed that one of the visitors' needs consists of accessing fauna and flora information so, it was very important to verify that sort of information in the study. With this table, it is possible to understand the most used features in a mobile application for natural parks. Although not all of them are used in every application, it is still important to understand the importance of each one for the user experience.

4. Usability Testing

4.1. Heuristics

Concerning the design and interface of each application, it is important to understand what the main problems are in order to avoid them when developing any king of application. Not only is it essential to detect the major as well as the minor problems, but also to identify what is well developed. In order to do this, it was necessary to make use of usability heuristics [17], which aim to detect major and minor problems [18]. Based on the Nielsen's heuristics, in this work it were used the usability checklists created by Sapo [14], since the former are not fully adapted to the mobile devices context. One of the disadvantages of Nielsen's heuristics lies in the fact that they are optimized for PC-web oriented systems. In order to apply them to a mobile context, it is necessary to resort, for instance, the Sapo usability checklists. They list detailed guidelines for each heuristic in the mobile context, for instance, checking if all

screens possess a title that informs about the system status; for the match between the system and the real word, it checks if all the icons are consistent and familiar. These are just small examples that should be taken into consideration in a mobile device context. It's important to take into account that this kind of evaluation is processed by the investigator and not by the final users, but the investigator should have sufficient knowledge to understand what is right or wrong in each heuristic [18]. Since these are not optimized for the natural parks applications, it is necessary complement them with other methods, such as the usability testing.

4.2. Evaluation

When developing interfaces for mobile devices, where the mechanism of interaction is the human finger on a relatively small screen, it is very important to make them simple and clear. Therefore, we used usability tests that allowed to check for the main problems of interaction design at: i) information structure and navigation level; ii) simplicity of the application; iii) the efficiency and effectiveness of the application. The usability tests will allow identifying problems through the experiences in a particular social and cultural context [15], since these tests consist in processes which the users are the main feedback source. It is very important to resort to this test in accordance with the heuristics since "these two categories of usability assessment methods have been shown to find fairly distinct sets of usability problems; therefore, they supplement each other rather than lead to repetitive findings" [11]. After the participants perform the test, and their personal data collected through the various test techniques and data collection, it is possible to understand what are the problems encountered in applications. After the analysis of these problems, it is possible to define some design guidelines that should be followed in developing a mobile application for natural parks.

To define these guidelines, four applications were selected in order to include those where a substantial amount of problems were detected as well as those that had very few. With this procedure, it was possible to include sufficiently heterogeneous applications in terms of problems detected in the heuristics analysis. For the participants' selection, six users were chosen with ages between 18 and 40, with some or no mobile device usage experience. This way, it was possible to guarantee that the sample is close to the target-users characteristics, thus obtaining more meaningful results.

To understand the efficiency, effectiveness and satisfaction of the users when using the application, it was necessary to define the test and data gathering techniques. As for the test techniques, to gather data it was used observation, where the participants would be accompanied along the modules route and, in a participatory manner, some data would be collected about the thoughts and difficulties that participants were having. This technique is very important since the users may not be aware of their experiences or be able to express them verbally. Also, the cognitive walkthroughs was considered since it makes users course along a given route, executing specific tasks. Finally, the thinking-aloud protocol was also used, since it was important to understand the participants difficulties and thoughts, verbalizing them during the test. To collect these kinds of data, the audio/video recording was used in order to register their reactions and actions. Checklists were also used, registering the participants' reactions and thoughts as well as some notes about their success in executing the given tasks. In the end, questionnaires were used in order to understand some of the participants' cognitive and personal aspects, such as mobile devices usage experience or personal importance of such application in the participants' lives. The tests were implemented in a laboratory room due to the lack of a nearby park access.

5. Results

After the presented analysis, it was possible to list the main features that should be developed in natural park applications. It is important that in these applications, the points of interest are accessible. The search functionality should also be available, allowing a simpler and easier access to them. Also, other kinds of information should be available: i) park and weather information; ii) security alerts; iii) a map with the points of interest; iv) the trails if it is the case; v) directions to a location; vi) available services (tickets, information center, infirmary, etc.); vii) commercial partners (restaurants, hotels, transportation); viii) accessibility information for people with special needs. The access to fauna and flora information as well the multilanguage features are very important despite the lack of use in the studied applications, since these give extra value while answering the visitors' needs [12]. All

these features were defined analyzing seven applications mentioned above in chapter 2, selecting the most used and possibly the most important according to the WebPark study [12]. In accordance with these features and using them as groundwork on the usability tests, it was possible to define a set of design guidelines that should be followed while developing a mobile device application in the natural parks' context. These consist mainly in not presenting too extensive textual information by providing a "More" option, or not using a menu at the bottom of the application if possible. In addition, it should always allow access to activities, sightseeing or services on the home screen of the application, since they must be properly grouped, and this screen should always be different from the rest. One should always remember that the most important buttons should be represented in the upper zone of the application and all icons and buttons should be fully explanatory of their place of destination. When listings are submitted, they must initially be ordered alphabetically or by distance, regardless of content type. Whenever any sorting action is performed by the user, the reason of explicit ordering must be presented, for example by showing the trails' time if the user has selected the option to sort by duration. All buttons shown on screen should be large enough and spaced to avoid navigation errors. As for the map accessibility, it should always be done through an icon landmark, as used in Google Maps. As for the map itself, it should fill the screen, except for menu buttons or others located in the application header. All secondary information such as contacts, points of interest and sites close to an item should be arranged in order of relevance and hidden by a "drop-down" button. Something very important is associated with the presentation of the back button on all screens and identifying them with an ever-present title corresponding to the current screen. One should also be careful not to use different colors for buttons or options with similar information structure except for the icons. Finally, information regarding the taking of directions must be available at the beginning of the description of a location.

These guidelines are the most important aspects to think about when starting to design and develop a mobile device application for a natural park, since they were scientifically tested with the end-users, the true judges and the most important sources of any kind of feedback while using a product [16].

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